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ABSTRACT

This work has been done as part of the effort to plan the National Institute of Education (NIE). The report, one of a series, describes a management plan recommended for the Basic Research Division of the proposed National Institute of Education. The plan was developed following a survey of management practices in a number of federal agencies supporting basic research activity, and incorporates many of the lessons learned through experience with a variety of management policies and practices. The report presents an overview of recommended management activity, the underlying choices that were made in the development of the management plan, and the alternative choices that would have resulted in alternative plans. Also provided is an evaluation of the recommended management plan based on criteria relevant to the quality of the supported R&D and the effectiveness of the management procedures related to required management skills, cost, time, and the ability to attract a supportive constituency. (Author/DN)

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A MANAGEMENT PLAN FOR THE BASIC RESEARCH DIVISION OF THE PROPOSED NATIONAL INSTITUTE OF EDUCATION

A. J. Lieberman and J. G. Wirt

A WORKING NOTE
prepared for the

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

This Note was prepared to facilitate communication of preliminary research results. Views or conclusions expressed herein may be tentative and do not represent the official opinion of the sponsoring agency.

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PREFACE

This working note contains a description of a management plan recommended for the Basic Research Division of the proposed National Institute of Education. The plan was developed following a survey of management practices in a number of federal agencies supporting basic research activity, and incorporates many of the lessons learned through the experience with a variety of management policies and practices.

The plan was developed in support of the work of the National Institute of Education Planning Unit, responsible for the preparation of an interim organization and management plan for the entire institute. Consequently, the management plan described here is consistent with the Interim Organization document released by the Planning Unit in April, 1972.

Material for the preparation of the Basic Research Division's management plan was taken primarily from one of a series of Rand documents concerning the proposed National Institute of Technology: WN-7676 entitled "National Institute of Education: Methods for Managing Fundamental Research." Others in the series include:

- National Institute of Education: Preliminary Plan for the Proposed Institute (R-657-HEW),
- National Institute of Education: Methods for Managing Practice-Oriented Research and Development (WN-7677-HEW),
- National Institute of Education: Methods for Managing Programmatic Research and Development (WN-7678-HEW),
- National Institute of Education: Organizational and Managerial Alternatives (WN-7679-HEW),
- National Institute of Education: Evaluation of Methods for Managing Research and Development (WN-7680-HEW).

This series of reports seeks to provide a basis for research into improved management practices for non-military federal R&D. The principal

purpose of these reports, however, is to enable the planners of the National Institute of Education to benefit from the experience of other federal R&D agencies in developing the NIE's R&D management procedures.

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I. INTRODUCTION

PURPOSE OF THIS REPORT

This report describes a management plan for the Basic Research Division of the National Institute of Education as described in the Interim Organization document of the NIE Planning Unit, April 15, 1972.

The plan is limited to the management of what has come to be known as fundamental or basic research. This is research undertaken primarily to add to knowledge about social, group, and individual behavior fundamental to education, rather than to further program goals or improve immediate practice. Basic research is conducted according to disciplined standards of inquiry that determine what experimental data are acceptable and by what means conclusions may be derived from stated assumptions or demonstrated facts. The standards of inquiry are established and preserved by the scientific community itself and each researcher's professional status is determined by the quality of his work as judged by his scientific peers.

Since progress in basic research is guided more by consideration of where solutions are possible and where intuition hints that new results are likely to be found than by the immediate practical value of results, basic research directions are ordinarily chosen primarily by the researchers themselves. This does not mean that practical problems can have no influence on the directions taken in basic research. Entirely new lines of research can be started in response to a practical need, and levels of effort allocated to different areas of inquiry can be adjusted to reflect their potential relevance to practice.

TYPES OF MANAGEMENT ACTIVITY

To facilitate presentation, the recommended management plan will be broken into three types of activity:

- o Program planning,
- o Program development,
- o Program evaluation.

These categories are deliberately chosen to group together qualitatively similar management activities.

Program Planning includes all the actions taken to foster, detect, and incubate research in new and ill-formed areas of inquiry. Also included are the procedures for deciding which new research areas will be added to the set of ongoing streams of activity, and the priorities for budget allocation among all areas of research considered for funding.

Program Development is managing the continuous process of refining and elaborating knowledge in an area. As a management process, Program Development is typically, though not always, *an iterative and continuing sequence* of stages involving:

- o Assessment of research needs,
- o Generation of project ideas,
- o Selection of projects to support,
- o Monitoring of project performance,
- o Evaluation of project outcomes, and
- o Utilization of results.

In various management paradigms, these stages are managed in different ways. Sometimes they are performed by program directors, sometimes by panels of scientists, and sometimes not at all. In most R&D, and especially when basic research is being done, action proceeds concurrently in several of the stages. This activity is called Program Development because from program management's perspective, basic research is continuously developing; it is evolutionary and expositional in nature: the goal of research is adding fine structure and precision to a basic idea, and this happens through a sequence of project generation, project selection, and outcome events that develop over a long period of time.

Program Evaluation is the assessment of what has been accomplished at some point in time by the researchers in a knowledge area, and the judgment of what ought to be done next.

Discussion of recommended management methods will focus on what is done at the *program director's* level, and only occasionally at higher levels.

PLAN OF THE REPORT

The presentation of the recommended management plan for the Division of Basic Research will be divided into three sections. Section II presents an overview of recommended management activity, in successively deepening detail. Section III presents the underlying choices that were made in the development of this management plan, and the alternative choices that would have resulted in alternative management plans. Finally, Section IV provides an evaluation of the recommended management plan according to criteria relevant to the quality of R&D supported and the effectiveness of the management procedures related to required management skills, cost, time, and the ability to attract a supportive constituency.

II. OVERVIEW OF THE RECOMMENDED MANAGEMENT PLAN

Four major alternative management processes have been identified and evaluated as candidates for the Division of Basic Research. These have been named: Dual Review, Single Panel Review, Mail Review, and No Review.* The plan recommended in this report has characteristics taken predominantly from the Mail Review paradigm, though characteristics from the other paradigms have also been utilized. The basic advantages and shortcomings of the Mail Review paradigm which is recommended for the Basic Research Division of the National Institute of Education are described in Section III of this report.

Mail Reviews are currently used in many places in the federal government, but particularly in the Engineering, Mathematical and Physical Sciences divisions of the National Science Foundation.** Experience with Mail Reviews extends back to the Foundation's inception and has been considered to be a satisfactory procedure by both Foundation management and by the scientific communities affected.

This plan does not recommend a complete duplication of NSF's Mail Review procedures. Instead, it describes the basic Mail Review paradigm modified (1) to be more responsive to the kinds of problems found in education, and (2) to maintain compatibility with current procedures used in funding the educational research projects that will be transferred from the Office of Education to the National Institute of Education. The essential features of the recommended management plan are:

- *Support is to be given to individuals* or institutions for work on *individual projects* that have been proposed.

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*J. Wise, A. Lieberman, and R. Levien, National Institute of Education: Methods for Managing Fundamental Research, WN-7676-HEW, The Rand Corporation, November 1971.

**The Mail Review procedures were invented and used by Wayne Gruner, who is now Senior Staff Associate, Research Directorate, National Science Foundation.

- o *Support is awarded for a limited period of time*, but can be renewed through presentation and approval of a new application.
- o *Proposals are evaluated by obtaining mailed comments* from a number of scientists expert in the area of the proposal.
- o *The majority of managerial effort is devoted to selecting a set of projects thought to balance most effectively* the various lines of research being pursued.
- o *Evaluation of research activity* is conducted periodically by convening *panels of outside scientists* who review the list of active projects.

GENERAL CHARACTERISTICS OF SUPPORT

Mechanism of support:	Finite duration project grants would be made to principal investigators of independent research projects. Generally, these scientists will be employees of a university or non-profit firm. A small amount of formula support may also be awarded to the grantee's institution.
Managerial emphasis:	Most managerial effort should be devoted to selecting the set of projects thought by division management to balance most effectively the lines of research being pursued by the institute.

Program Planning

Role of Planning:	Planning in the Basic Research Division should be concerned with setting allocation priorities among the various research areas to be funded by the Division. Within priority areas, clusters of projects may be grouped under a program director.

Type of Planning:

Primary planning activities would include travel, conferences, and workshops to promote communication among the research communities concerning the selection of priority areas among fields of research.

Program Development

Sources of project ideas:

Scientists primarily outside the institute would be funded to work on problems that they have defined. Occasionally, a scientist's interest in a priority area might be stimulated by contact with a program director. These program directors would offer advice and technical assistance to project applicants.

Means of proposal review:

Each proposal would be sent to a group of specialists in the field of inquiry for mailed comments on the technical quality of the project idea and plan, the reputation of the principal investigator, and the availability of needed research facilities. Returned comments would then be compiled and sent back to each reviewer for additional comments and rebuttals.

Procedures for the selection of projects:

The program directors would discuss priorities and research opportunities with scientists and educational practitioners throughout the year. They would also interact with special panels of outside scientists who review their programs annually or semi-annually.

At the budget allocation time, occurring at regular intervals of one year or six months, the program director would choose the set of projects that his discussions and previous mailed reviews have convinced him offer the best combination of research opportunities. This method would allow him to compare the merits of competing proposals against each other, rather than to select proposals for funding independently of each other.

Monitoring of project performance:

Substantive progress on projects would not be closely monitored, though progress reports and site visits for major projects would be required. Monitoring activity would be conducted by project officers within the division and would be primarily intended to provide technical assistance and communication to the R&D performers on events and advances within other projects, and feedback information to the program directors on promising research areas or needs identified during the course of project activities.

Evaluation of project outcomes:

Projects would not be subjected to formal evaluations. Instead, the Project Officer, with consultation from outside scientists where needed, would provide some assessment on the quality and potential utilization of research results to program directors concerned with future allocation priorities and stimulation of proposals in areas of promise.

Program Evaluation

Means of evaluation:	A panel of outside scientists, permanently constituted, would meet to review the selection decisions made by each program director after awards have been granted. The format would be a round-table discussion during which panelists would ask questions regarding quality of research supported, relevance of projects to programs of the institute, and balance among fields supported. Each panel would review all the projects within a specified program area.
Timing of the evaluation:	A review session would be held semi-annually, shortly after each period during which project grants are awarded.
Purpose or implementation of evaluation results:	Program directors would utilize the results of the panel reviews as a guide in determining future allocation priorities. In addition, the reviews would help communicate to the research and practitioner communities the results and contributions of R&D supported by the institute.

DETAILED DESCRIPTIONS OF MANAGEMENT ACTIVITIES

Within this management plan, program directors do not interact with outside scientists, convened in panels, to decide jointly on project selections. Instead, the directors use representatives of the research community as consultants, providing assessments on the individual merits of project proposals regarding technical quality, reputation of the principal investigator, and availability of research facilities.

Comparisons among candidate projects competing for funds are made by the program directors themselves, and are judged subsequently by panels of outside scientists convened periodically to review the entire mix of active projects. In this way, the staff of the Basic Research Division can provide direction and promote concentration of effort to selected research areas of high priority.

Program Planning

Programs of the Basic Research Division would actually be clusters of projects related by discipline, and not collections of logically interrelated projects deduced from a set of overall goals. Thus, "fields of inquiry" might be a better name than "programs" for these units of activity. Especially important new ideas that seem likely to develop into a distinctive field of inquiry would be nurtured by the program staff through the usual means: traveling, workshops, conferences, and general persuasion. Some responsibility for detecting and encouraging these new ideas should lie with the program directors; but in addition, a senior program director reporting at the top management level may spend all his time searching out and stimulating nascent fields of inquiry which offer significant potential. His principal means of project stimulation would be the same as the program director's.

Program Development

At intervals throughout the year, the program directors would visit scientists in their fields of inquiry, discussing new trends, important events, and research options. These discussions would help the program directors form their scientific priorities, and keep them informed; but also serve to stimulate research proposals.

Proposals would be received in the program director's office throughout the year from individual investigators. The program director would sort through the stack of received proposals and select those that seem to qualify for review in terms of preparation of study plan, budget, and personnel specifications. Each proposal selected for review would be sent to four or five specialists for a written review of its merits. The specialists would be chosen to match the subject area of the proposal and would be given guidelines on the important criteria to consider in writing their review.

The program director would select these reviewers from a list kept as up to date as possible. If the proposal is particularly complicated or if it receives mixed reviews initially, additional reviews may be solicited from other members of the list. The first round of replies would be summarized and mailed to each first round reviewer, who might then revise his original review and send it back to the program director. Upon receiving all the second round reviews, the program director would have an expert, external assessment of a proposal's worth.

Two or three times a year, the program director would examine the backlog of reviewed proposals and select a subset of them which fits his budget and which he believes to be an "optimal" balance of innovative ideas, normal science progress, special opportunities, and chances for development of new research talent in the lines of research he is pursuing. The budget of some proposals may be altered to eliminate weak portions, or increase strong ones. In these cases, the program director would negotiate with the applicants concerning these changes. The program director's final choices would then be reviewed and approved by his organizational superiors.

Grants would be awarded for a fixed amount of money; expendable over a specified period of time, usually less than a five-year period. During this time, annual progress reports would be requi , but unless major difficulties arise, the investigator would be free to choose his course. An investigator who is not making reasonable progress may be given one year's notice prior to a final decision to revoke his grant, but this should occur only infrequently. Project outcomes would not be evaluated on a formal basis.

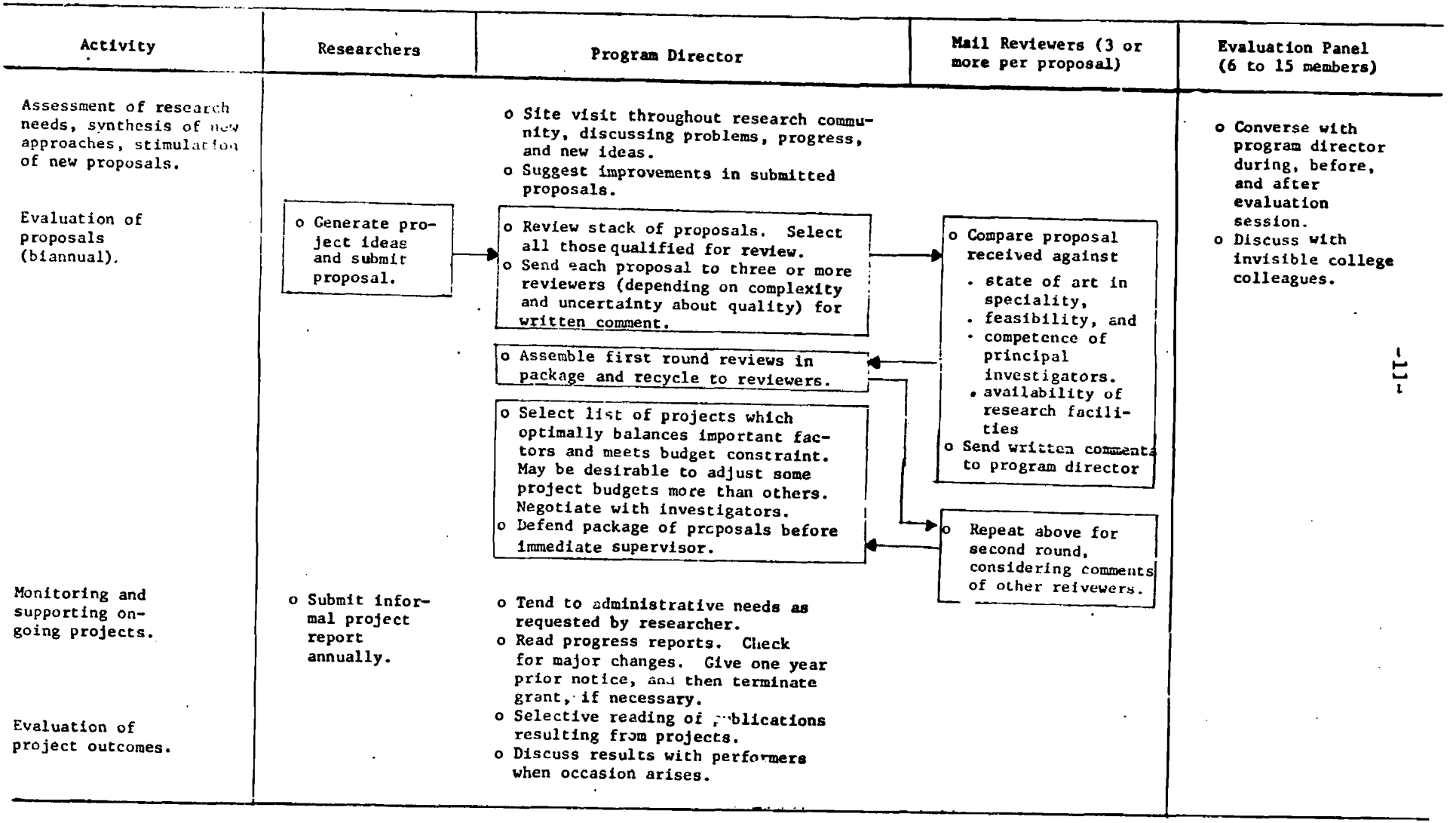
A flow chart of this proposed process appears in Fig. 1.

Program Evaluation

Programs would be evaluated by a panel of scientists, specifically appointed for the purpose. The panel would convene shortly after each period when project awards are made to review the list of projects selected and rejected, and cross-examine the program directors on their decisions. The panel would evaluate all the programs managed by a section of the division, usually encompasing from three to six programs.

The meeting format would not be highly structured, but rather informal.

Figure 1: Program Development Procedures in the Management Plan for the Basic Research Division



The chairman of the panel, elected by the panel members themselves, would ask each program director in turn to describe briefly his project selection decisions. Following this presentation, the meeting would be opened for round-table discussion. The attitude of the program staff should be to "throw open the files, and let the panel see any thing they want." Back and forth discussion on each program would proceed for a while until all opinions are on the table. The panel could then vote a resolution if desired, but usually the spoken comments of the members would constitute adequate evaluations.

These evaluations would be reflected in future decisions only if the program directors wished to follow them. Scientists' opinions about the abilities of a program director would easily find their way back to the program director's supervisors. In addition, the section supervisor would attend the panel meeting, and talk with the panelists on an individual basis whenever the need arises.

Staffing

Program Directors. With rare exception, all would have Ph.D.s or the equivalent. The turnover rate should be limited to one departure per approximately two positions, for half of the staff, and one departure per approximately eight years for the rest. Each program director would be selected by his immediate suprevisor.

Mail Reviewers. Mail reviewers would be selected by the program director with the objective of obtaining a match between topics in the proposed research and specialties covered by the reviewers. The list from which reviewers are drawn should be frequently updated, and sufficiently long that only rarely would any reviewer see more than three proposals per year. A great deal of effort must be expended to build and maintain the list of mail reviewers. Mail reviewers should be paid between $25 and $50 for each proposal reviewed.

Panel. The program directors and their suprevisors would select replacement panelists from the community of scholars, with approval required from the Division Director. The term of office should be for only two years, but there should also be no statutory limitation. The

panelists should span a greater range of research interests than the programs evaluated, and may include applications-oriented researchers. Panelists should be paid for their services, at a rate of approximately $100 per day. This would encourage them to read the proposals, and particularly important, to familiarize themselves with the programs and priorities of the Division.

III. CHOICES MADE WHICH FORM THE BASIS OF THE MANAGEMENT PLAN

ISSUES OF RESEARCH SUPPORT

1. Alternative mechanisms of support representing different degrees of contractual specification:
   (1) Investigators are relatively free to pursue activity in the area of support without committment to producing an agreed product. Support of this kind is usually provided by means of a grant, though contracts may be used.
   (2) Researchers are committed to produce a defined product. Support of this kind is almost always provided by contract.

   Alternative chosen for this management plan:
   (1) Support predominantly through grants.
2. Alternative means of dispensing basic research funds:
   (1) Support is provided on an independent project basis, either to a single principal investigator or to a predetermined project group. Actual funds may be given either directly to the project or to the university or institution of the investigator, in support of the particular project.
   (2) Support is given to institutions which support multi-project basic research activity, on a formula grant basis, or as core support for a number of individual projects.

   Alternative chosen for this management plan:
   (1) Support on an individual project basis.
3. Alternatives concerning the duration of support:
   (1) Support is given on a continuing basis, contingent only on continuing productivity.
   (2) Support is given only for a limited period of time, but can be renewed through presentation and approval of a new application.

Alternative chosen for this management plan:

(2) Support for a limited period of time, and renewable.

PROGRAM PLANNING ISSUES

1. Alternative amounts of planning activity engaged in by the Division of Basic Research:

   (1) No Planning. Unsolicited proposals are processed and selected for funding on the basis of their individual merits.

   (2) Planning activity is limited to the identification of gap areas of research. This information may then influence selection of unsolicited or stimulated projects.

   (3) Planning activity includes the determination of allocation priorities. In this case, gap areas are identified as well as specific areas of research which are labeled as high priority areas. Project selection and stimulation may then be carried on in light of these allocation priorities.

   (4) Emphasis on planning. In this case, division planners identify the specific research objectives and steps that are needed to achieve predetermined goals of the division. Grants or contracts are then let for the accomplishment of individual steps.

   Alternative chosen for this management plan:

   (3) Planning includes determining allocation priorities.

2. Alternative forms of planning activity:

   (1) Travel to universities and research institutions and to practitioner communities to establish communication on problems and needs for research.

   (2) Conferences of the practitioner community to discuss the role of research and development in solving practical problems, and to determine priorities for research.

   (3) Workshops of the research community to establish research priorities and communicate the results of R&D needs.

(4) Problem Analyses. Studies to determine the importance of educational problems, and to identify their causes and potential solutions.

(5) Program Analyses. Identification of the research steps needed to achieve program objectives.

Alternatives chosen for this management plan:

(1) and (3) as major planning activities for the Basic Research Division.

3. Alternative performers of the planning activity (Who does the planning?)

(1) Division Director.

(2) Branch Chiefs or Program Directors.

(3) Project Officers.

(4) Teams of internal staff of the Basic Research Division serving a planning role.

(5) Teams of outside researchers called on an ad hoc basis.

Alternatives chosen for this management plan:

(1), (2), and (3) for travel;

(2), (3), and (5) for workshops among researchers.

PROJECT IDEA GENERATION AND PROPOSAL DEVELOPMENT ISSUES

1. Alternative sources for project ideas:

(1) Branch chiefs and Project Officers.

(2) Project reviewers.

(3) University or independent researchers.

(4) Non-profit organizations or others contracted for project generation.

Alternative chosen for this management plan:

Greatest reliance on (3) with supplemental contributions from (1) and (2).

2. Alternative degrees of stimulation or encouragement for project generation in gap or high priority areas identified by planning activities:

(1) No stimulation. All project ideas are unsolicited and stem from outside the division.

(2) Limited stimulation through advertisement of areas that the division considers high priority, using announcements or notifications by the Division to the research community.

(3) High degree of stimulation and encouragement through travel to research location, workshops of members of the research community, and advertisement of high priority areas of research in research journals.

Alternative chosen for this management plan:

(3) High degree of project stimulation.

3. Alternative degrees of technical assistance given by the staff of the Basic Research Division to researchers in the preparation of project ideas and proposals:

(1) No technical assistance.

(2) Limited assistance through telephone calls on the strengths and weaknesses of proposals prior to their formal evaluation and/or following their rejection.

(3) Written reviews and technical assistance to authors of selected proposals prior to formal evaluation, and/or following their rejection.

(4) Written reviews and technical assistance to authors of all proposals prior to formal evaluation and/or following rejection.

Alternative chosen for this management plan:

(3) Reviews and assistance to selected authors of proposals.

PROPOSAL EVALUATION AND SELECTION ISSUES

1. Alternatives concerning the relative amount of project selection power granted to representatives of the research community:

(1) Total Power: In this case, project selection may be conducted by panels of peer scientists with no review or approval, power given to internal institute staff.

(2) Major Power: In this case, representatives of the research community actually determine the funding priority for proposals, and staff personnel act as consultants to the panels, screening proposals to be reviewed and administering site visits.

(3) Limited Power: In this case, representatives of the research community serve as consultants to the internal staff, either through mail reviews of project proposals, or through panel discussions to evaluate the technical quality of project proposals. Other evaluations concerning relevance and project balance would be conducted by the staff.

(4) No Power: In this case, project selection is conducted entirely by the internal staff, with no systematic procedures for evaluation by the research community.

Alternative chosen for this management plan:

(3) Limited project selection power given to the research community.

2. Alternative criteria for project selection:

(1) Technical quality of the project idea and plan.

(2) Reputation of the principal investigator.

(3) Availability of research facilities for the conducting of the research plan.

(4) Relevance of the project to ongoing programs and interests of the entire institute.

(5) Training value of the project (bringing new people into areas where greater research is needed).

Alternative chosen for this management plan:

No single criterion; instead, a balance among (2) through (5) with a required minimum rating in (1).

3. Alternative sources of proposal reviewers:

(1) The research community outside the institute.

(2) The research staff within the institute.

(3) The management staff within the institute.

(4) Mixture of researchers from within and outside the institute.

(5) Mixture of researchers and management staff from within the institute.

Alternative chosen for this management plan:

(1) Research community outside the institute.

4. Alternative procedures for the selection of projects:

(1) Internal staff approves proposals clearly desirable, rejects proposals clearly undesirable, and submits all remaining proposals to a panel of representatives of the research community who then review for technical quality and make recommendations for funding or rejection.

(2) Internal staff approves proposals clearly desirable, rejects proposals clearly undesirable, and requests written mail reviews for assessments of technical quality on all remaining proposals, then makes decisions on funding based on these mail reviews.

(3) Requests for mail reviews on the technical quality of all proposals are made and serve as guides to funding decisions by the internal staff.

(4) Panels are convened to review all proposals and make recommendations for funding to the internal staff based on the consideration of technical quality only.

(5) Panels are convened to review all proposals and make recommendations for funding to the internal staff based on considerations of technical quality, relevance to ongoing programs and interests, and balance among projects approved for support.

Alternative chosen for this management plan:

(3) Mail reviews on technical quality for all proposals qualified for review.

5. Alternative number of reviews given each proposals selected for review:

(1) Single review in which all assessments are submitted independently to the internal staff for funding decisions.

(2) Two-stage review in which evaluations of all reviewers are circulated among themselves so that revisions or rebuttals may be made prior to recommendations to the internal staff for funding decisions.

(3) Dual review in which outside scientists review for technical quality and internal management staff review for relevance and balance.

(4) Dual review in which one review is held prior to funding decisions and one held subsequent to project completion for purposes of project evaluation.

(5) Combinations of the above.

Alternative chosen for this management plan:

(2) Two rounds of mail review prior to project selection.

6. Alternatives for the timing of proposal review and selection:

(1) Group reviews are initiated whenever a predetermined number of proposals have been received.

(2) Group reviews are initiated at regular intervals such as annually or semi-annually.

(3) Reviews are initiated individually whenever a proposal is received.

Alternative chosen for this management plan:

(2) Group reviews at regular intervals.

PROJECT MONITORING ISSUES

1. Alternatives for what is monitored:

(1) Fiscal audit.

(2) Substance audit (progress and quality).

(3) Personnel usage audit.

(4) Compliance to contractual or agreed obligations.

(5) Nothing is monitored.

Alternative chosen for this management plan:

Emphasis on (2) substance audit.

2. Alternatives for who monitors?

(1) Internal management staff (Project Officers).

(2) Ad hoc teams of outside researchers.

(3) Ad hoc teams of outside and institute researchers.

(4) Ad hoc teams of management consultants.

(5) Subgroup of the reviewers who participated in the Project evaluation.

Alternative chosen for this management plan:

(1) Project Officers of the internal management staff.

3. Alternatives for the role of monitoring:

(1) To maintain compliance with contractual or agreed obligations.

(2) To provide technical assistance where needed.

(3) To provide communication on events and information to the research performers on relevant issues and advances.

(4) To provide communication to planners and managers of the internal staff on events and advances in the field.

(5) To collect information for subsequent project evaluation.

Alternative chosen for this management plan:

Emphasis on (2), (3), and (4); assisting and communicating.

4. Alternative degrees of monitoring activity:

(1) Minimal monitoring; mostly by phone.

(2) Required progress reports at regular intervals.

(3) Site visits and progress reports at regular intervals.

(4) Continual communication, written or verbal, on progress, problems, directions, and plans.

Alternative chosen for this management plan:

(2) For most basic research projects.

PROJECT EVALUATION ISSUES

1. Alternatives on what is evaluated:

(1) Nothing; final reports are merely entered into the project information system for subsequent retrieval by other researchers.

(2) Timeliness of output.

(3) Quality of substance of report.

(4) Compliance to what was asked for or agreed up on.

(5) Degree to which research is implemented within an operating program.

(6) Degree to which research results are utilized by other researchers.

(7) Effectiveness of management within the project.

Alternative chosen for this management plan:
Emphases on (3), and (6) stressing quality and utilization.

2. Alternatives concerning who conducts the evaluations of projects:

(1) Project Officers or internal staff of the division.

(2) Project Leader or principal investigator of the project.

(3) Subgroup of the reviewers who participated in the evaluation prior to selection.

(4) Ad hoc group of outside scientific reviewers.

(5) Higher institute management (Branch Chiefs, Division Director, or Advisory Council).

Alternative chosen for this management plan:
(1) Project Officers with consultation from ad hoc groups of outside scientists where needed.

3. Alternatives for the primary role of project evaluation:

(1) Subsequent selection situations involving the same principal investigator.

(2) Feedback for planning; information on progress or new problems arising in the pursuit of research objectives; i.e., future allocation decisions.

(3) Communication to the research community on the identification and selection of new ideas and research needs; e.g., for project stimulation purposes.

Alternative chosen for this management plan:
All, but with an emphasis on (2) and (3); i.e., evaluation for subsequent decisionmaking and project stimulation.

ISSUES OF PROGRAM OR OVERALL ACTIVITY EVALUATION

1. Alternatives concerning what is evaluated:
   (1) Quality of research supported.
   (2) Relevance of research supported to ongoing programs and interests of the entire institute.
   (3) Covering of gap areas of research.
   (4) Balance or mix among research areas supported; geographically, by discipline, and substantively.
   (5) Progress toward overall objectives of the institute for the division.

   Alternative chosen for this management plan:
   More emphasis on (1), (3), and (4); Quality, gap, and mix.

2. Alternatives concerning who conducts the evaluation of division programs or branch activities:
   (1) Division Director.
   (2) Higher Management; e.g., NIE Director and/or National Advisory Council.
   (3) A permanent or ad hoc group of outside scientists who review the project selection decisions made by each program officer.
   (4) Institute staff of the Office of Policy, Planning, and Evaluation.
   (5) Combinations of the above.

   Alternative chosen for this management plan:
   (3) Permanent groups of outside scientists prepare the major program evaluations for the division. Additional evaluations may be conducted by higher management and the institute staff.

3. Alternatives for the primary role of program or branch activity evaluation:
   (1) For subsequent selection of individual projects.
   (2) For subsequent changes in the allocation priorities.
   (3) For assessments of managerial competence and resulting personnel changes.

(4) For communication to the research community and to the general public on the progress and activities of the institute in the pursuit of solutions vital to the future of education.

Alternative chosen for this management plan:

(2) The primary role of program evaluation is to determine desirable changes in the allocation priorities among research areas; other roles are of secondary importance.

IV. EVALUATION OF THE RECOMMENDED MANAGEMENT PLAN

CHARACTERISTICS THAT PROMOTE THE TECHNICAL QUALITY OF THE R&D CONDUCTED

Amount and quality of scientific expertise consulted in the project selection process:	The variant of the Mail Review paradigm described here provides the greatest number and greatest selectivity of expert opinion concerning each proposal selected for review of the alternatives examined. Proposals are reviewed by as many experts as needed. Additionally, the second round of mailed comments expose reviewers to the opinions of other experts before asking them to make their final evaluations.
Consideration given to risky projects in comparison to:	Reliance on program directors rather than panels of peer scientists for final selection of the proper mix of research projects helps reduce the possibility of limiting projects funded to those employing traditional methods and carried out by investigators of established reputation. Workshops and site visits also provide program directors with opportunities to assess research potential independent of conventional views.
Vulnerability of conflicts of interest regarding:	If a scientist's professional reputation is based on existing theory, he might not value a proposal that might threaten existing theory as highly as another whose professional status

	is not tied to the existing theory. Since final project decisions in this management plan are made by program directors, vulnerability to this kind of conflict of interest is reduced.
Ability of management to concentrate resources on selected problems of high priority:	Reviewing proposals by evaluating each one separately without comparison to others being evaluated tends to disperse research effort, because it is more difficult to give extra weight to the funding of proposals that are similar or complementary in nature. Within the management plan proposed here, group evaluation and the overall perspective of the program director allow a relatively high degree of concentration among resources of the Basic Research Division.
Attractiveness of management procedures to the R&D community:	Attractiveness of the variant of the mail review paradigms proposed here is limited by the following factors: finite term support; low visibility of proposal reviewers, which limits the number of inquiries from potential performers; and since mail reviews are not announced publicly, low linkage with the R&D community. Visibility, communication, and linkage are provided outside the selection procedures, through the more direct activities of travel, workshops, conferences, and frequent contacts with mail reviewers.

Vulnerability to decisions based on personal favor:

Decision power placed in the hands of a program director reduces the possibility of "backscratching" among members of the scientific community, but requires a high degree of integrity for the directors themselves. This integrity is ensured partly by the panel which convenes to review the decisions made, and guards against favoritism by the program directors. Appeal by an applicant in this variant of the mail review paradigm is difficult, but applicants may contact members of their evaluation team as they wish.

OTHER CHARACTERISTICS THAT PROMOTE THE EFFECTIVENESS OF THE INSTITUTE

Ability to Attract a Supportive constituency:

Participation of the research community in the decisionmaking process helps build a supportive constituency in at least three ways: by building confidence that the research programs are well run, by building proprietary interests in the welfare of active programs, and by developing appointment to a decisionmaking council as a mark of distinction. In these regards, the variant of mail review recommended here contributes relatively little to the NIE's attractiveness to its research constituency because of the low profile of mail reviewers and the relatively larger amount of

	decision power given to the program director.
Sensitivity of the management process to the skills of a few managers:	Effectiveness of the management procedures described here is fairly dependent on the acquisition of competent program directors. Use of leading scientists as mail reviewers makes this job easier. Program directors must be capable of convincing researchers that they will get a fair hearing, and do so without excessive documentation and scientific assistance or handling of countless complaints.
Cost of the management process:	The average program management team within the Division of Basic Research should consist of one Program Director, one shared Assistant Program Director who covers two or three program areas, and one secretary. The average direct labor cost of this team should be roughly $45,000 per year. At any one time, 3-6 programs may be in operation. The cost of the permanent panels that periodically review the decisions of the Program Directors should be $10,000 per year or less for each of the 4-6 discipline-oriented division branches. These costs are not significantly below those of other systems requiring permanent review panels rather than mailed reviews.

Average time required to process an application for funding:

The time to process a proposal is defined ehre as the period that elapses between the deadline for submission of an application and the time when the grantee knows whether or not he will be funded. In the variant of mail review described here, which includes a second round of reviews, this average time may range from four to six months. Relative to other management processes applied to basic research operations, this time period is not particularly long.